

## **REMARKS**

Careful consideration has been given by the applicants to the Examiner's comments and rejection of various of the claims, as set forth in the outstanding Office Action, and favorable reconsideration and allowance of the application, as amended, is earnestly solicited.

Applicants gratefully note the Examiner's indication that at least Claims 9-15 are directed to allowable subject matter and would be allowed if rewritten so as to be dependent from an allowable claim, or revised into independent form.

However, in addition to the foregoing, upon careful consideration of the art, as applied to the remaining claims, applicants respectfully submit that amended Claim 1 and the various claims which are dependent therefrom, are also deemed to be directed to allowable and patentable subject matter.

Concerning the foregoing, prior to traversing the prior art, applicants note that the specification and claims have been fully amended in formal respects, as requested by the Examiner in the Office Action, thereby rendering moot any discussion of informalities which were outstanding concerning the application.

Reverting to the cited prior art, as applied to Claims 1-8, as set forth in the Office Action, applicants note that Claims 3 and 4 have been cancelled without prejudice or disclaimer. Pertaining to the specific application by the Examiner of the prior art, applicants note that Claims 1-6 and 8 have been rejected under 35 U.S.C. §102(a) as being anticipated by Wittren, U.S. Patent No. 4,367,803, as detailed in Paragraph 4 of the Office Action; whereas Claim 7 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Wittren in view of Bohner, et al., U.S. Patent No. 5,953,978; and Claim 16 has been rejected under 35 U.S.C. §103(a) as being unpatentable over Wittren in view of Li, U.S. Patent No. 5,937,966.

Accordingly, upon careful consideration of the art, applicants respectfully submit that the rejected claims, in addition to already allowable Claims 9-15, are also deemed to be allowable over the art cited in the Office Action.

In particular, with respect to independent Claim 1, this is clearly novel and inventive over the various publications cited under either 35 U.S.C. §102(a) or 35 U.S.C. §103(a) in the Office Action, concerning which applicants respectfully submit as follows in traverse of the rejections thereof:

The rejection with respect to Wittren, U.S. Patent No. 4,367,803:

Wittren discloses two steering cylinders 12 and 13, in which cylinder pistons 16 and 17 are displaceable, the position and/or direction of motion of which in the steering cylinders fix the steering angle and/or steering direction of steerable vehicle wheels relative to the body or chassis of the vehicle. Each of the displaceable cylinder piston 12 and 13 divides the steering cylinders 12 and 13 into, in each instance, two adjusting pressure chambers, i.e., chamber 22 and combined chambers 24 and 26 for the steering cylinder 12; as well as chamber 23 and combined adjusting pressure chambers 25 and 27 for the steering cylinder 13. Hereby, the variable hydraulic pump 39 is the only hydraulic pump whose first port is connected to one of the adjusting pressure chambers 22 or 23 of the first or second steering cylinder 12 or 13, depending upon the steering direction performed by the steering wheel 54, the metering pump 52 and the control valve 42. The metering pump 52 is connected to the adjusting pressure chambers 24 and 26 of steering cylinder 12 and to adjusting pressure chambers 25 and 27 of steering cylinder 13 without affording any possibility or capability of

switching to another adjusting pressure chamber in dependence upon the steering angle and/or steering direction.

The second port of the variable hydraulic pump 39 is connected in an open hydraulic circuit to a reservoir 38, but is not connected in a closed loop to the other adjusting pressure chambers 24 and 26 of the first steering cylinder 12 and to the other adjusting pressure chambers 25 and 27 of the first steering cylinder 13, as is set forth in Claim 1.

The rejection with respect to Bohner, et al., U.S. Patent No. 5,953,978:

In Bohner, et al., the hydraulic power steering system has only one steering cylinder 4, but not at least two steering cylinders, as is set forth in present Claim 1. The hydraulic pump 18 in the hydraulic power steering system of Bohner, et al. is connected in an open hydraulic circuit via the reservoir 19 to the adjusting pressure chambers of the steering cylinder 4, whereby a closed hydraulic circuit is not disclosed in this publication.

The rejection with respect to Li, U.S. Patent No. 5,937,966:

As disclosed in Li, the hydraulic pump 21 is a constant hydraulic pump and is connected in an open hydraulic loop via the reservoir 56 to the adjusting pressure chambers of the two steering cylinders 34 and 36. A variable hydraulic pump working in a closed hydraulic circuit corresponding to applicants' Claim 1 is not disclosed in Li.

Furthermore, upon careful consideration of the prior art, applicants note, in particular with regard to the disclosure of Li, as follows:

It is Wittren which, upon closer analysis, represents the closest state of the art in applicants' opinion, because only in the Wittren document is there disclosed a variable

hydraulic pump 39 for producing a variable pressure difference between the two pressure chambers of the two steering cylinders, whereas Bohner, et al. disclose a constant hydraulic pump 18, while a constant hydraulic pump 21 is also disclosed in Li.

Additional Distinctions over the Prior Art:

Moreover, the disclosure of Wittren differentiates from the subject-matter of Claim 1 by an open hydraulic circuit, the variable hydraulic pump and the two adjusting pressure chambers of both steering cylinders.

In an open hydraulic circuit, it is possible to only provide for one flow direction of the hydraulic fluid. Therefore, the two adjusting pressure chambers of both steering cylinders cannot be disadvantageously loaded with complementary adjusting pressure, i.e., with a positive or a negative pressure of a specific absolute value, corresponding to the intended steering angle and the intended steering direction without using an additional hydraulic device. In case of the steering system in Wittren, the metering pump 52 with the hydraulic connection between reservoir 64 and control valve 42 via hydraulic line 62 (dotted line in hydraulic pump 52) is provided for feeding the hydraulic fluid in the load circuit to the respective adjusting pressure chambers in the two steering cylinders depending on the selection of the steering angle and steering direction.

With respect to the foregoing, applicants, in general, further note as follows:

Thus, it is an object of the invention to develop a hydraulic steering system without using an additional hydraulic device, which in combination with the variable hydraulic pump, can feed the hydraulic fluid with a specific pressure in both directions of the load circuit depending on the selected steering angle and steering direction.

Moreover, the inventively closed hydraulic circuit between the variable pump and the two adjusting pressure chambers of both steering cylinders is not obvious to a person skilled in the art, i.e., an engineer engaged in oil hydraulics, from the disclose of Bohner, et al. and Li, whereby:

In Bohner, et al., there is employed only one steering cylinder 4 with equal pressurization areas in both pressure chambers, enabling a specific steering angle and a specific steering direction in dependence of the adjusting pressure in the pressure chamber connected directly with the hydraulic pump 18.

Furthermore, in Li, there is integrated an additional hydraulic pump 32 into the open hydraulic circuit, which in combination with the constant hydraulic pump 21 feeds the hydraulic fluid with a specific pressure in both directions of the load circuit, depending upon the selected steering angle and steering direction.

From the foregoing, it is clearly evident that the presently presented and amended claims, in addition to allowable Claims 9-15, are also deemed to be directed to patentable subject matter, inasmuch as the application is concerned with a hydraulic steering system possessing the essential feature that by means of two cylinders, which are so interconnected so as to form a synchronous cylinder, and in that an implemented steering motor with a variable hydropump relative to the pumping volume is operated in a closed hydraulic circuit.

The foregoing concept clearly indicates in Claim 1 that there is a significant distinction between a variable pump and a constant pump, wherein none of the publications cited by the Examiner disclose a hydraulic steering system in which the steering motors can be operated with a variable hydraulic pump (capability of changing the quantity of the

pumping medium without any change of the rotational drive speed) in a closed hydraulic circuit.

In the steering system, pursuant to Wittren, the pump 52 possesses a constant flow or pressure medium volume and is designated as a "metering pump", inasmuch as its pump quantity provides a measure for the speed at which the steering wheel is rotated.

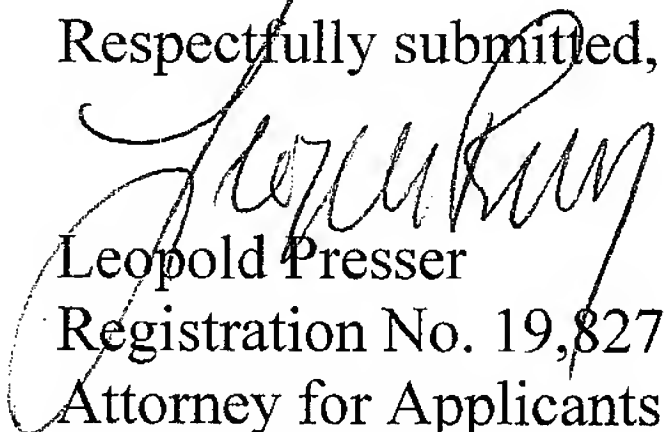
Bohner, et al. discloses a cylinder 13 with a piston which is displaceable by means of the steering wheel, and wherein the volume of the pumping medium cannot be varied.

None of the publications cited by the Examiner disclose a steering system with a closed hydraulic circuit between the steering motors and a variable pump.

Accordingly, inasmuch as none of these features which are currently set forth and clearly claimed in Claim 1, and in the dependent claims, are shown in the prior art, irrespective as to whether these are considered singly or in combination, applicants respectfully submit that Claims 1, 2 and 5-8, as well as 16, are deemed to be allowable, in addition to already allowable Claims 9-15, whereby the favorable reconsideration of the application and issuance of the Notice of Allowance by the Examiner is earnestly solicited.

However, in the event that the Examiner has any queries concerning the instantly submitted Amendment, applicant's attorney respectfully requests that he be accorded the courtesy of possibly a telephone conference to discuss any matters in need of attention.

Respectfully submitted,

  
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